FACTS

Ministry of the Environment
Ontario

Hon. William G. Newman, Minister

Everett Biggs, Deputy Minister

ABOUT WASTE

COMPOSTING: AN EDUCATIONAL FACT SHEET ON RECYCLING ORGANIC WASTE

(This Fact Sheet was prepared as an educational tool and includes several suggestions for classroom activities.)

I Introduction

Composting involves taking organic waste material such as kitchen and table "left-overs", grass clippings, plant trimmings, leaves or weeds, and placing them in a soil 'culture' rich in natural soil organisms. The mixture must be kept well aerated (by occasional turning if necessary) but is allowed to go through a natural "fermentation" process, whereby the soil organisms change the original materials into a compost soil.

To initiate the composting process, one may use most any organically rich top-soil. Various additives such as manure or a commercial 'starter' such as Fertizan (purchased from a local garden centre) will insure a speedy start.

II Why set up a compost?

i) To prepare a soil conditioner and fertilizer for use in potting plants, in gardening or simply in developing a healthy lawn.

ii) To reduce the volume of ones own "garbage".

iii) For students, or teachers, to prepare a concentrated culture of soil organisms for school lab studies.

iv) To study a rather bizarre artificial ecosystem in which decomposers, scavangers and predators abound.

III Facts on Constructing a "Home Recycling Soil-Building Unit"...

The following directions and illustrations were provided by Mr. S.G. Hambly, Director of Camp Allsaw, a summer camp in Ontario where environmental issues play an important role in day-to-day activities. Mr. Hambly's compost design is just one of many possibilities, but has proven to be quite successful over many years of use.

"To set up a recycling facility:

"Get one sheet of 1/4 inch aspenite plywood, cut into sections 2 ft. x 4 ft. Put a frame of 2" x 2" stock around each section. Set the panels up to form a square 2 ft. x 4 ft. Drill the corners 4 inches from top and bottom and fasten together with 1/4 inch bolts or wire. Two squares provide a two-storey recycling unit. Make 2 covers - one of plywood 4 ft. x 4 ft. 3-1/2", a second of plastic on a frame of 2" x 2" stock, the same size.

"The plastic lid conserves moisture and keeps out flies in summer weather. It also enables the facility to be used as a hotbed for growing seedlings in the spring. The wooden cover can be used on the second storey or stored for use during winter months to keep out the snow.

"Set up the frame(s) and fill them with a mixture of leaves, straw, hay, grass clippings, other organic waste and some farm manure. Add water to make the mixture moist. This provides a medium to get the culture started.

"In three months, add 2 gallons of active soil culture containing a variety of soil-building life. (Mr. Hambly suggests earthworms obtained from a local bait supplier as necessary additives to the culture.)

"In summer, assemble the contents of the unit, with a plastic garbage pail from which the bottom has been removed in the centre of the mixture. This enables the operator to funnel fresh organic waste to the bottom of the mass of culture. The soil - culture life - bacteria, fungi, earthworms, springtails, sow bugs, etc., will feed from beneath. A tightly fitted lid on the bottomless garbage pail and a plastic cover on the unit make the facility sanitary for use in urban areas.

"In winter (mid-October to April) use styrofoam insulation and plastic to conserve the natural 40° F. temperature of the earth and the chemical heat generated by the composting mass of organic waste.

"To do this, use panels of styrofoam 3' 9" x 2' 9" on the plywood sides of the box inside the 2" x 2" frome. This may be secured by styrofoam contact cement.

"For extra warmth put a 2 ft. border of 2" styrofoam protected by 3/8" plywood on top and the ground around the unit.

"Inside the unit, remove the plastic funnelling cylinder. Mix the mass to a homogeneous mixture.

"On top of the mass, spread a sheet of plastic for a vapor barrier. Over this, Over this, place 2 panels of 2 inch styrofoam (3' 9" x 1' 10"). This leaves some space for ventilation around the edge. Cover the unit with the wooden plywood cover.

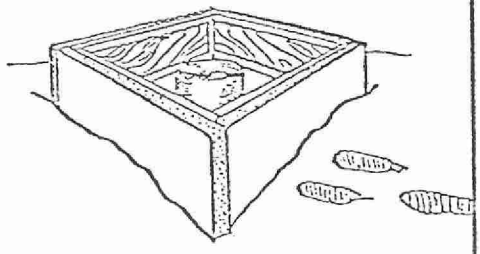
"As the kitchen garbage accumulates in winter, spread it on top of the soil culture mixture under the vapour barrier. A good technique is to remove one panel and turn back the vapour barrier on alternate days or weeks.

"To check the temperature within the unit, place a thermometer with a plastic frame under the vapour barrier.

"Hence a good supply of food (a variety of kitchen garbage), heat, moisture, and air, enable the soil-building life within the culture to propagate and function throughout all seasons.

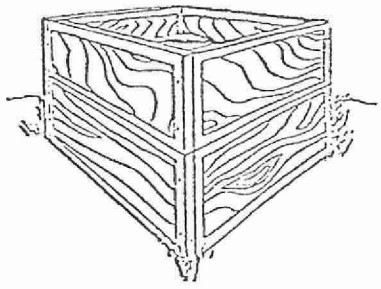
"This is a year-round ecology and conservation environmental activity. Related investigation and experiments using a microscope and other equipment can motivate practical interest in the environment."

HOME RE-CYCLING SOIL-BUILDING UNIT



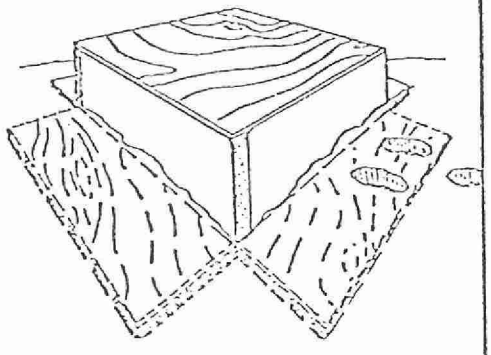
SINGLE UNIT:

. with cylinder to funnel organic food to soil culture animals.



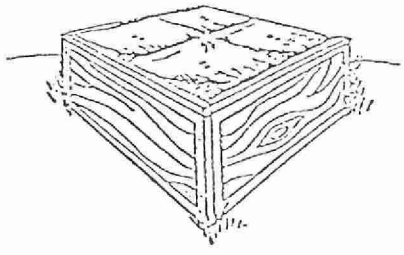
TWO-STOREY UNIT:

. for more volume, leaves, etc.
. for greater volume, camps, etc, use more units.



WINTERIZED UNIT:

. cylinder removed
. styrofoam outer wall panels
. vapor barrier over organic content.
. styrofoam panels over vapor barrier
. plywood lid on unit
. plywood over 2" styrofoam border.



SUMMER UNIT:

. cylinder with lid inside
. plastic cover on 2"x2" frame with holes to admit moisture.

IV A Few Facts on the Biology of Compost

The organisms listed below are the major residents of a compost soil.

- Actinomycetes
- Ants (Formicid) 5-10 m.m.
- Bacteria
- Beetle mites 1 m.m.
- Centipedes 30 m.m.
- Earthworms 50-150 m.m.
- Feather-winged Beetles (Ptilliids) 1-2 m.m.
- Fly (Diptera) 1-2 m.m.
- Ground Beetles (Carabid) 8-20 m.m.
- Land Snails and Slugs 2-25 m.m.
- Millipedes 20-80 m.m.
- Mold (Fungi)
- Mild Mites (Acaria) 1 m.m.
- Predatory Mites .5-1 m.m.
- protozoa 0.01-.5 m.m.
- Pseudoscorpions 1-2 m.m.
- Rotifera 0.1-0.5 m.m.
- Roundworms (Nematodes) 1 m.m.
- Rove Beetles (Staphylinid) 10 m.m.
- Soil Flatworms (Turbellarians) 70-150 m.m.
- Sow-bugs (Isopod) 10 m.m.
- White Worms (Enchytracids) 10-25 m.m.

All of the above organisms are consumers. In the ecological food webs and chains that develop in compost soil, it is possible to distinguish primary, secondary and tertiary level consumers.

V Facts concerning the use of compost

1. Compost 'soil' generally contains less than 1 percent by weight of nitrogen, 0.05 to 0.2 percent by weight of phosphate, and from 0.2 to 0.3 percent by weight of potassium.

2. Compost 'soil' has many of the characteristics of humus and therefore tends:

   i) to hold moisture; and
   ii) to provide an environment for the establishment of a biological system from which nitrogen is released slowly over an extended period of time.

3. Compost 'soil' invariably has a high trace elements content.

4. Compost can reduce soil erosion in three ways:

   i) by absorbing the energy contained in falling raindrops when they make impact with the soil surface;

ii) by reducing the amount of surface runoff of water because of the water-holding capacity of compost; and

iii) by soil particle aggregation - as the compost turns into humus through biological processes, soil particles tend to get aggregated giving the soil textural strength. This in part is caused by humic acid that forms during the compost 'fermentation'.

5. The use of compost invariably shows best results, for the garden enthusiast, in those instances where the initial soil was either heavy clay or nearly straight sand.

6. Compost enrichment of soils tends to 'buffer' them against chemical reactions (for instance the chemical effects of accidentally adding too much fertilizer are reduced by the buffering capability of compost).

7. Compost provides better soil aeration.

8. Compost, during its decomposition releases heat and carbon dioxide, both stimulants to plant growth.

VI Questions and Suggestions for Consideration

1. Find out from 2 people active in gardening what their definition of a "soil conditioner" would be, and compare and contrast their ideas to one or two definitions obtained from any text which covers the topic.

2. Find out the meaning of the following words:

i) mulch;
ii) humus;
iii) percolation;
iv) capillarity;
v) pore space; and
vi) nutrient

3. Find out whatever information you can about i) the food habits;
ii) life cycles;
iii) and major predators of;
one or more of the organisms listed in Section III.

4. Prepare a food web for 7 or more of the organisms listed in Section III.

5. Describe some (up to 5) of the major problems that would be encountered if a city were to compost organic waste on a large scale.

VII Suggested Activities

1. Construct a Berlese or Tullgren funnel to isolate soil dwelling arthropods from:

   i) natural forest litter and top soil;
   ii) natural grassland top soil; and
   iii) compost soil.

   Consult books on ecology at a school or public library for the design.

2. Compare the moisture content of compost 'soil' and various natural soils. Weigh given samples before and after heating at 100° c for 24, 48 or 72 hour periods (or until the weigh becomes constant). Design other experiments to compare the physical characteristics of compost as opposed to natural soils.

3. Write the Garbage Coalition,
   c/o 43 Queen's Park Cres. E.,
   Toronto, Ontario. M5S 2C3
   for more information.

VIII READINGS:

The Forest by Peter Farb and the Editors of Life, The Life Nature Library Series, Time Inc., 1961. Chapter 7, "The Hidden World of the Soil", is an excellent introduction to the topic.

A Guide to the Study of Soil Ecology by Andrews et al., Prentice-Hall, 1973. See chapters 3, 4 and 5 especially. They are titled "Life in the Soil: Macrofauna," "Life in the Soil: Micro-organisms," and, "Field and Laboratory Studies."

Mini-Climates by Couchman et al., Holt, Rinehart and Winston of Canada, Ltd., 1971. Chapter 5, "Soil in a Mini-Climate" provides a number of ideas concerning simple equipment and studies that can be undertaken by anyone.

Recycling by T. Fegely, Rodale Press, Inc., Emmaus, Pennsylvania, 1973. This excellent publication suggests activities for students from Kindergarten to eight grade.

Teaching Science with Garbage by A. Schatz and V. Schatz, Rodale Press Inc., 1971. Basic information, activities and projects on soil chemistry, biology, soil organisms, etc.